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1914
PRINCETON, N. J.

Technical Paper 79

Petroleum Technology 19

DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
JOSEPH A. HOLMES, DIRECTOR

ELECTRIC LIGHTS

FOR USE ABOUT OIL AND GAS WELLS

BY

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WASHINGTON
GOVERNMENT PRINTING OFFICE
1914

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Issued in August, 1914.

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ELECTRIC LIGHTS FOR USE ABOUT OIL AND GAS WELLS.

By H. H. CLARK.

INTRODUCTION.

In connection with its investigations looking to the improvement of safety conditions in the mineral industries the Bureau of Mines has paid especial attention to the dangers attending the use of electricity. The incandescent electric lamp is clearly much safer than any form of open flame for lighting gaseous places. It is true that the use of electric lamps entails the presence of conductors that may give dangerous flashes, but it is possible to install electric lighting systems so carefully and in such a thorough manner that the possibility of obtaining such flashes is remote.

There is, however, another danger associated with the use of electric lights in gaseous places. The filaments of the lamps glow at very high temperatures, and the breaking of the bulb of a lamp while surrounded with explosive gas instantly brings the gas into violent contact with the filament. The inrush of gas destroys the filament almost invarably, but while the filament is being destroyed the gas may become ignited.

DANGER FROM ELECTRIC LIGHTS AT OIL WELLS.

An illustration of the danger of gas being ignited by incandescent lamps used for lighting the drilling rigs of gas wells is given in a recent field report of J. J. Rutledge, mining engineer of the Bureau of Mines. The driller on duty at the time of the fire declared that a pebble blown from the well struck and broke an incandescent lamp bulb, so that the gas from the well was ignited by coming in contact with the broken filament. The resulting fire totally destroyed the rig and caused considerable additional damage. The lamp that was supposed to have caused the accident was rated 60 watts (approximately 16 candlepower), 110 volts.

This accident was decidedly unusual, and the accuracy of the driller's observations may be questioned, but the possibility of such an ignition of gas has been well established by experiments made by the Bureau of Mines, which indicate that incandescent lamps are a potential source of danger that should be safeguarded wherever inflammable gas may be present in explosive proportions.

RESULT OF TESTS BY BUREAU OF MINES.

The Bureau of Mines has investigated the ignition of explosive gas by the filaments of incandescent lamps thoroughly with respect to carbon filament lamps and to a lesser extent, but not less conclusively, with respect to tungsten filament lamps. The detailed results of these investigations have been described,[a] and for the present purpose it is sufficient to state that all standard sizes of carbon filament lamps ignited the gas at least once in a series of tests made by breaking off the tips of the bulbs, and that all sizes of standard carbon filament lamps except those rated 8 candlepower, 220 volts, ignited the gas when the bulbs were broken by smashing, as with a club, stone, or other missile.

Some 110 and 220 volt tungsten lamps of 25 watts capacity that were also tested by smashing in the presence of explosive gas ignited the gas in 25 to 85 per cent of the trials. Some sizes of lamps ignited the gas in almost every trial, while other sizes of lamps caused ignition in only a few of many trials, but it was observed that the tendency to cause ignition decreased as the lamps decreased in candlepower and increased in voltage. As stated above, the one size of lamp that failed to produce ignition when smashed under normal conditions was the 8-candlepower, 220-volt carbon-filament lamp, and even this size of lamp caused a single ignition out of 20 trials made by breaking the tip from the bulb and allowing the gaseous mixture to enter in a small stream that did not break the filament.

It is especially noteworthy that the tests made with tungsten-filament lamps seemed to indicate that they are much more dangerous than carbon-filament lamps of the same rating. For instance, the safest carbon-filament lamp was rated 35 watts at 220 volts, but a tungsten-filament lamp rated 25 watts at 220 volts ignited an explosive mixture in more than one-fourth of the trials made by smashing the lamp, whereas a tungsten lamp rated 25 watts at 110 volts caused the gas to ignite in more than 85 per cent of the trials made by smashing the lamp.

LIGHTING EQUIPMENT RECOMMENDED FOR OIL AND GAS WELLS.

The results of these tests seemed to show that the best incandescent lamp to use for lighting gaseous places is the 8-candlepower, 220-volt, carbon-filament lamp, and that the safety of this lamp can be largely increased by using bulbs that are constructed without a tip.

The electric wiring used in connection with the lighting of gaseous places should, within the limits of the region made dangerous by the presence of gas, be carried in iron-pipe conduit, and the fittings, such as switches, sockets, and junction boxes, should be made to correspond. If it is necessary to install the switches where gas is liable to be present, the switch boxes should be made gas tight.

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[a] Clark, H. H., and Ilsley, L. C., Ignition of mine gases by the filaments of incandescent lamps: Bull. 52, Bureau of Mines, 1913, 31 pp.

Additional safeguards around lamp bulbs, such as heavy glass outer globes and metallic guards outside the outer globes, provide a factor of safety that is highly desirable.

SUGGESTED SPECIFICATIONS FOR A SAFE ELECTRIC LIGHTING SYSTEM FOR OIL AND GAS WELLS.

The following suggested specifications for an electric-lighting system for oil and gas wells cover lamps, transmission line and the wiring near the well.

LAMPS.

Voltage of lamps	220
Candlepower of lamps	8
Kind of filaments	Carbon.

MECHANICAL PROTECTION OF LAMPS.

Outer globes	Heavy glass, making air-tight inclosures around bulbs.
Guards	Heavy metal, securely fastened to the support of the outer globe.

TRANSMISSION LINE.

Insulation of conductors	Double-braided, weatherproof.
Spacing of conductors	Ample everywhere, and not less than 24 inches anywhere except in pipe or where entering fittings.
Support of conductors	Securely tied to glass or porcelain insulators that are carefully installed so as not to be strained or cracked.

WIRING AT WELL AND WHEREVER GAS IS LIKELY TO BE PRESENT.

Insulation of conductors	Rubber-covered, double-braided.
Support of conductors	In iron-pipe conduit.
Sockets and receptacles for lamps	Keyless—well constructed and insulated (preferably not with brittle material like porcelain) and mounted in steel boxes to which conduit can be secured.
Switches	Indicating. Switch contacts inclosed in gas-tight inclosure. Switches should be installed as far as possible from the presence of gas.
Fuses	Should be provided for every twenty 8-candlepower, 220-volt lamps used. Should be inclosed in gas-tight inclosures made so that they can be connected to conduit.

PUBLICATIONS ON PETROLEUM TECHNOLOGY.

A limited supply of the following publications of the Bureau of Mines is available for free distribution. Requests for all publications can not be granted, and applicants are asked to limit their selection to publications that may be of especial interest to them. Requests for publications should be addressed to the Director, Bureau of Mines.

TECHNICAL PAPER 3. Specifications for the purchase of fuel oil for the Government, with directions for sampling oil and natural gas, by I. C. Allen. 1911. 13 pp.

TECHNICAL PAPER 10. Liquefied products from natural gas; their properties and uses, by I. C. Allen and G. A. Burrell. 1912. 23 pp.

TECHNICAL PAPER 25. Methods for the determination of water in petroleum and its products, by I. C. Allen and W. A. Jacobs. 1912. 13 pp., 2 figs.

TECHNICAL PAPER 26. Methods of determining the sulphur content of fuels, especially petroleum products, by I. C. Allen and I. W. Robertson. 1912. 13 pp., 1 fig.

TECHNICAL PAPER 32. The cementing process of excluding water from oil wells as practiced in California, by Ralph Arnold and V. R. Garfias. 1913. 12 pp., 1 fig.

TECHNICAL PAPER 36. The preparation of specifications for petroleum products, by I. C. Allen. 1913. 12 pp.

TECHNICAL PAPER 37. Heavy oil as fuel for internal-combustion engines, by I. C. Allen. 1913. 36 pp.

TECHNICAL PAPER 38. Wastes in the production and utilization of natural gas and means for their prevention, by Ralph Arnold and F. G. Clapp. 1913. 29 pp.

TECHNICAL PAPER 42. The prevention of waste of oil and gas from flowing wells in California, with a discussion of special methods used by J. A. Pollard, by Ralph Arnold and V. R. Garfias. 1913. 15 pp., 2 pls., 4 figs.

TECHNICAL PAPER 49. The flash point of oils; methods and apparatus for its determination, by I. C. Allen and A. S. Crossfield. 1913. 31 pp., 2 figs.

TECHNICAL PAPER 51. Possible causes of the decline of oil wells and suggested methods of prolonging yield, by L. G. Huntley. 1913. 32 pp., 9 figs.

TECHNICAL PAPER 57. A preliminary report on the utilization of oil and natural gas in Wyoming, by W. R. Calvert, with a discussion of the suitability of natural gas for making gasoline, by G. A. Burrell. 1913. 23 pp.

TECHNICAL PAPER 66. Mud-laden fluid applied to well drilling, by J. A. Pollard and A. G. Heggem. 1914. 21 pp., 12 figs.

TECHNICAL PAPER 68. Drilling wells in Oklahoma by the mud-laden fluid method, by A. G. Heggem and J. A. Pollard. 1914. 25 pp., 5 figs.

TECHNICAL PAPER 70. Methods of oil recovery in California, by Ralph Arnold and V. R. Garfias. 1914. 57 pp., 7 figs.

TECHNICAL PAPER 72. Problems of the petroleum industry, results of conferences at Pittsburgh, Pa., August 1 and September 10, 1913, by I. C. Allen. 1914. 20 pp.

TECHNICAL PAPER 74. Physical and chemical properties of the petroleums of California, by I. C. Allen, W. A. Jacobs, A. S. Crossfield, and R. R. Mathews. 1914. 38 pp., 1 fig.

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